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1 Virtual memory and backing storage management in multiprocessor operating systems using object-oriented design techniques ⬛

V. F. Russo, R. H. Campbell

September 1989 **ACM SIGPLAN Notices , Conference proceedings on Object-oriented programming systems, languages and applications**, Volume 24 Issue 10

Full text available: 📄 pdf(1.19 MB)   Additional Information: full citation, abstract, references, citings, index terms

The Choices operating system architecture [3, 4, 15] uses class hierarchies and object-oriented programming to facilitate the construction of customized operating systems for shared memory and networked multiprocessors. The software is being used in the Tapestry Parallel Computing Laboratory at the University of Illinois to study the performance of algorithms, mechanisms, and policies for parallel systems. This paper describes the architectural design and class hierarchy of ...

2 Fast and flexible application-level networking on exokernel systems ⬛

Gregory R. Ganger, Dawson R. Engler, M. Frans Kaashoek, Héctor M. Briceño, Russell Hunt, Thomas Pinckney

February 2002 **ACM Transactions on Computer Systems (TOCS)**, Volume 20 Issue 1

Full text available: 📄 pdf(500.67 KB)   Additional Information: full citation, abstract, references, citings, index terms

Application-level networking is a promising software organization for improving performance and functionality for important network services. The Xok/ExOS exokernel system includes application-level support for standard network services, while at the same time allowing application writers to specialize networking services. This paper describes how Xok/ExOS's kernel mechanisms and library operating system organization achieve this flexibility, and retrospectively shares our experiences an ...

Keywords: Extensible systems, OS structure, fast servers, network services

3 Promises and reality: Server I/O networks past, present, and future ⬛

Renato John Recio

August 2003 **Proceedings of the ACM SIGCOMM workshop on Network-I/O convergence: experience, lessons, implications**

Full text available: 📄 pdf(225.62 KB)   Additional Information: full citation, abstract, references, index terms

Enterprise and technical customers place a diverse set of requirements on server I/O networks. In the past, no single network type has been able to satisfy all of these requirements. As a result several fabric types evolved and several interconnects emerged to satisfy a subset of the requirements. Recently several technologies have emerged that enable a single interconnect to be used as more than one fabric type. This paper will describe the requirements customers place on server I/O networks; t ...

Keywords: 10 GigE, Cluster, Cluster Networks, Gigabit Ethernet, I/O Expansion Network, IOEN, InfiniBand, LAN, PCI, PCI Express, RDMA, RNIC, SAN, Socket Extensions, TOE, iONIC, iSCSI, iSER

4 <u>The implementation of a coherent memory abstraction on a NUMA multiprocessor:</u> <u>experiences with platinum</u>
A. Cox, R. Fowler
November 1989 **ACM SIGOPS Operating Systems Review , Proceedings of the twelfth ACM symposium on Operating systems principles**, Volume 23 Issue 5

Full text available: <u>pdf(1.62 MB)</u>   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

PLATINUM is an operating system kernel with a novel memory management system for Non-Uniform Memory Access (NUMA) multiprocessor architectures. This memory management system implements a coherent memory abstraction. Coherent memory is uniformly accessible from all processors in the system. When used by applications coded with appropriate programming styles it appears to be nearly as fast as local physical memory and it reduces memory contention. Coherent me ...

5 <u>Sheaved memory: architectural support for state saving and restoration in pages</u> <u>systems</u>
M. E. Staknis
April 1989 **ACM SIGARCH Computer Architecture News , Proceedings of the third international conference on Architectural support for programming languages and operating systems**, Volume 17 Issue 2

Full text available: <u>pdf(973.26 KB)</u>   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

The concept of read-one/write-many paged memory is introduced and given the name sheaved memory. It is shown that sheaved memory is useful for efficiently maintaining checkpoints in main memory and for providing state saving and state restoration for software that includes recovery blocks or similar control structures. The organization of sheaved memory is described in detail, and a design is presented for a prototype sheaved-memory module that can be built easily from inex ...

6 <u>Surpassing the TLB performance of superpages with less operating system support</u>
Madhusudhan Talluri, Mark D. Hill
November 1994 **Proceedings of the sixth international conference on Architectural support for programming languages and operating systems**, Volume 29 , 28 Issue 11 , 5

Full text available: <u>pdf(1.50 MB)</u>   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

Many commercial microprocessor architectures have added translation lookaside buffer (TLB) support for superpages. Superpages differ from segments because their size must be a power of two multiple of the base page size and they must be aligned in both virtual and physical address spaces. Very large superpages (e.g., 1MB) are clearly useful for mapping special structures, such as kernel data or frame buffers. This paper considers the architectural and opera ...

7 Sharing and protection in a single-address-space operating system

Jeffrey S. Chase, Henry M. Levy, Michael J. Feeley, Edward D. Lazowska

November 1994 **ACM Transactions on Computer Systems (TOCS)**, Volume 12 Issue 4

Full text available: pdf(2.87 MB)   Additional Information: full citation, abstract, references, citings, index terms

This article explores memory sharing and protection support in Opal, a single-address-space operating system designed for wide-address (64-bit) architectures. Opal threads execute within protection domains in a single shared virtual address space. Sharing is simplified, because addresses are context independent. There is no loss of protection, because addressability and access are independent; the right to access a segment is determined by the protection domain in which a thread executes. T ...

Keywords: 64-bit architectures, capability-based systems, microkernel operating systems, object-oriented database systems, persistent storage, protection, single-address-space operating systems, wide-address architectures

8 Towards efficient parallel radiosity for DSM-based parallel computers using virtual interfaces

Luc Renambot, Bruno Arnaldi, Thierry Priol, Xavier Pueyo

October 1997 **Proceedings of the IEEE symposium on Parallel rendering**

Full text available: pdf(1.18 MB)   Additional Information: full citation, references, citings, index terms

Keywords: global illumination, parallel computing, radiosity, realistic image synthesis, virtual interface, visibility mask

9 Improving the efficiency of UNIX buffer caches

A. Braunstein, M. Riley, J. Wilkes

November 1989 **ACM SIGOPS Operating Systems Review , Proceedings of the twelfth ACM symposium on Operating systems principles**, Volume 23 Issue 5

Full text available: pdf(1.46 MB)   Additional Information: full citation, abstract, references, citings, index terms

This paper reports on the effects of using hardware virtual memory assists in managing file buffer caches in UNIX. A controlled experimental environment was constructed from two systems whose only difference was that one of them (XMF) used the virtual memory hardware to assist file buffer cache search and retrieval. An extensive series of performance characterizations was used to study the effects of varying the buffer cache size (from 3 Megabytes to 70 MB); I\O transfer sizes (from ...

10 Special system-oriented section: the best of SIGMOD '94: QuickStore: a high performance mapped object store

Seth J. White, David J. DeWitt

October 1995 **The VLDB Journal — The International Journal on Very Large Data Bases**, Volume 4 Issue 4

Full text available: pdf(2.58 MB)   Additional Information: full citation, abstract, references, citings

QuickStore is a memory-mapped storage system for persistent C++, built on top of the EXODUS Storage Manager. QuickStore provides fast access to in-memory objects by allowing application programs to access objects via normal virtual memory pointers. This article presents the results of a detailed performance study using the OO7 benchmark. The study compares the performance of QuickStore with the latest implementation of the E programming language. The QuickStore and E systems exemplify the two ba ...

11 Fbufs: a high-bandwidth cross-domain transfer facility

Peter Druschel, Larry L. Peterson

December 1993 **ACM SIGOPS Operating Systems Review , Proceedings of the fourteenth ACM symposium on Operating systems principles**, Volume 27 Issue 5

Full text available: pdf(1.35 MB)   Additional Information: full citation, abstract, references, citings, index terms

We have designed and implemented a new operating system facility for I/O buffer management and data transferacross protection domain boundaries on shared memory machines. This facility, called *fast buffers* (fbufs), combines virtual page remapping with shared virtual memory, and exploits locality in I/O traffic to achieve high throughput without compromising protection, security, or modularity. goal is to help deliver the high bandwidth afforded by emerging high-speed networks to user-leve ...

12 A new page table for 64-bit address spaces

M. Talluri, M. D. Hill, Y. A. Khalidi

December 1995 **ACM SIGOPS Operating Systems Review , Proceedings of the fifteenth ACM symposium on Operating systems principles**, Volume 29 Issue 5

Full text available: pdf(1.97 MB)   Additional Information: full citation, references, citings, index terms

13 QuickStore: a high performance mapped object store

Seth J. White, David J. DeWitt

May 1994   **ACM SIGMOD Record , Proceedings of the 1994 ACM SIGMOD international conference on Management of data**, Volume 23 Issue 2

Full text available: pdf(1.73 MB)   Additional Information: full citation, abstract, references, citings, index terms

This paper presents, QuickStore, a memory-mapped storage system for persistent C++ built on top of the EXODUS Storage Manager. QuickStore provides fast access to in-memory objects by allowing application programs to access objects via normal virtual memory pointers. The paper also presents the results of a detailed performance study using the OO7 benchmark. The study compares the performance of QuickStore with the latest implementation of the E programming language. These systems exemplify ...

14 Increasing TLB reach using superpages backed by shadow memory

Mark Swanson, Leigh Stoller, John Carter

April 1998 **ACM SIGARCH Computer Architecture News , Proceedings of the 25th annual international symposium on Computer architecture**, Volume 26 Issue 3

Full text available: pdf(1.32 MB) Additional Information: full citation, abstract, references, citings, index
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The amount of memory that can be accessed without causing a TLB fault, the reach of a TLB, is failing to keep pace with the increasingly large working sets of applications. We propose to extend TLB reach via a novel Memory Controller TLB (MTLB) that lets us aggressively create superpages from non-contiguous, unaligned regions of physical memory. This flexibility increases the OS's ability to use superpages on arbitrary application data. The MTLB supports shadow pages, regions of physical address ...

15 Virtual address translation for wide-address architectures

Ing-Jye Shyu, Shiuh-Pyng Shieh
October 1995 **ACM SIGOPS Operating Systems Review**, Volume 29 Issue 4
Full text available: pdf(569.30 KB)   Additional Information: full citation, abstract, index terms

> Operating systems employ virtual memory mechanism to provide large address space for programs. The efficiency of the virtual address translation plays an important role in determining system performance. In conventional virtual memory management systems, both the forward-mapped page table scheme and inverted page table scheme are widely used to organize the page tables that record translation data. These two schemes work well for 32-bit architectures, but not for wide address (64-bit) architectu ...

16 Virtual memory primitives for user programs
Andrew W. Appel, Kai Li
April 1991 **Proceedings of the fourth international conference on Architectural support for programming languages and operating systems**, Volume 26 , 19 , 25 Issue 4 , 2 , Special Issue
Full text available: pdf(1.37 MB)   Additional Information: full citation, references, citings, index terms

17 Atomic incremental garbage collection and recovery for a large stable heap
Elliot K. Kolodner, William E. Weihl
June 1993 **ACM SIGMOD Record , Proceedings of the 1993 ACM SIGMOD international conference on Management of data**, Volume 22 Issue 2
Full text available: pdf(1.34 MB)   Additional Information: full citation, abstract, references, citings, index terms

> A stable heap is storage that is managed automatically using garbage collection, manipulated using atomic transactions, and accessed using a uniform storage model. These features enhance reliability and simplify programming by preventing errors due to explicit deallocation, by masking failures and concurrency using transactions, and by eliminating the distinction between accessing temporary storage and permanent storage. Stable heap management is useful for programming lang ...

18 MERT - a multi-environment real-time operating system
D. L. Bayer, H. Lycklama
November 1975 **Proceedings of the fifth ACM symposium on Operating systems principles**
Full text available: pdf(968.55 KB)   Additional Information: full citation, abstract, references, index terms

> MERT is a multi-environment real-time operating system for the Digital Equipment PDP-11/45 and 11/70 computers. It is a structured operating system built on top of a kernel which provides the basic services such as memory management, process scheduling, and trap handling needed to build various operating system environments. Real-time response to processes is achieved by means of preemptive priority scheduling. The file system structure is optimized for real-time response. Processes are bui ...

> **Keywords**: Kernel, Operating system, Process, Supervisor

19 Mapping irregular applications to DIVA, a PIM-based data-intensive architecture
Mary Hall, Peter Kogge, Jeff Koller, Pedro Diniz, Jacqueline Chame, Jeff Draper, Jeff LaCoss, John Granacki, Jay Brockman, Apoorv Srivastava, William Athas, Vincent Freeh, Jaewook Shin, Joonseok Park
January 1999 **Proceedings of the 1999 ACM/IEEE conference on Supercomputing (CDROM)**
Full text available: pdf(111.41 KB)   Additional Information: full citation, references, citings, index terms

20 Operating system support for high-speed communication
Peter Druschel
September 1996 **Communications of the ACM**, Volume 39 Issue 9

Full text available: pdf(313.01 KB)   Additional Information: full citation, references, citings, index terms, review

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and "size" and "pointer"
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